SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

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TELEVISION SEES COLORS

Bell Laboratories Demonstrate Latest Achievement

(See page 3)

Vol. XVI No. 430

Earth Rays May Be Evolution Cause

Biology

Rays from the earth itself may be the exciting cause of evolutionary changes in animals and plants. Invisible, short-wave radiations, similar to those given off by radium, have been shown by two University of California experimenters, Dr. E. B. Babcock and Dr. J. L. Collins, to cause mutations, which are the type of change now believed to be responsible for most evolutionary development. This is the first experimental demonstration of an actual evolutionary driving force, emanating from the earth itself.

Not long ago, the scientific world was excited over the wholesale production of mutations by shooting heavy doses of X-rays through the germ-plasm tissues of animals and plants. It was suggested then that similar changes might occur in nature, through the agency of similar radiations known to be given off by the earth. These natural rays are, of course, much feebler than the powerful units used in the laboratory, so that the number of mutations to be looked for in nature would be only a small fraction of those produced under the X-ray tube.

The method of testing that occurred to Dr. Babcock and Dr. Collins was to expose genetically similar strains of fruit-flies in two different localities, one of which was known to have more earth-radiation than the other. By means of sufficiently delicate instruments, they found that the rocks in Twin Peaks tunnel, San Francisco, gave off about twice as much radiation as did the soil of the University of California campus at Berkeley. Accordingly they arranged to expose their comparison cultures in these two places.

The strain of fruit flies they used was known to be liable to produce a mutation of the kind called "sex-linked lethal". That is, every once in so often a culture would arise in which all the males died before hatching, leaving nothing but females in the bottle. Not a very useful sort of mutation, of course, but for demonstration purposes as good as any.

After five months of industrious fly-culturing, the two researchers checked up their records, and found that in the more highly radiant tunnel locality the mutation they were watching occurred about twice as often as it did on the university campus. It turned up in only a small fraction of the cultures in either place, but the percentage was constant and consistent. They regard it as a fair demonstration of the connection between X-ray-like radiations from the earth and the occurrence of evolutionary changes.

"It seems fairly safe to conclude even now," they state, "that the natural ionizing radiation of the earth is an important factor affecting the rate at which new inherited characters appear in animals and plants. While it may not be inferred that ionizing radiation is the direct cause of mutation, yet a way is now open by which this question can be attacked experimentally. But no matter whether earth radiation actually causes mutation or whether it only affects its rate of occurrence, there can be little doubt that it has played and is playing an important role in in the great drama of organic evolution.

"It is well known that there is always more or less ionizing radiation at the surface of the earth; also that there are various natural sources of radioactive materials. Radioactive mineral deposits which lie near the surface of the earth may perhaps be considered the most important sources of the ionizing radiation which presumably affects the course of evolution. Comparative biological surveys of the natural flora and fauna in regions found to have constantly higher rates of ionizing radiation than those which obtain as a general rule on the surface of the earth may reveal valuable confirmatory evidence in support of these findings.

"Of broad theoretical interest, this discovery has equally important practical aspects for agriculture and perhaps even for man himself. The possibilities appear especially attractive in the case of domestic animals which are not so easily treated experimentally with X-rays or radium as are plants for the purpose of inducing new hereditary characters."

Science News-Letter, July 6, 1929

In This Issue—

U. S. in Radio Conference

Radio

International agreement on radio wave lengths, assignment of special bands for aviation and police use, limitations of power of broadcasting stations and establishment of some international service for measurements of frequency, may be some of the results of an international radio conference to be held in the Hague, beginning September 19. An appropriation of $27,500 for expenses of the American delegation, passed by Congress a few hours before recessing, assures American participation.

Commissioner H. A. LaFount and Capt. Guy Hill, chief engineer, will represent the Federal Radio Commission at the Conference, while other representatives will be chosen by the State Department. These will be selected from the various government departments operating research laboratories and having radio facilities. American companies and radio associations desiring to send representatives may do so, and the State Department has asked that it be given their names.

Science News-Letter, July 6, 1929

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Color Television Makes American Debut

Television

The day when we shall not only see our distant friends as we talk to them over the telephone, but when we shall also see the flesh tints of their faces, the red of their lips and the colors of their clothes, was brought nearer with the demonstration of color television at the Bell Telephone Laboratories in New York on June 27. Color television has been achieved previously in England, but the Bell demonstration was the first time that it had been done in this country, and much nearer perfection.

In one part of the laboratory building a girl in a fancy dress sat in front of the transmitter, as shown on our cover picture. A group of newspaper men and scientists in the auditorium sat in front of the receiver and saw a faithful reproduction of her dress and features in all their natural hues. An American flag was held in front of the transmitter and the red, white and blue were immediately reproduced in the receiver. Flowers, fruit and other colored subjects were also transmitted.

It was on April 7, 1927, that the first satisfactory long-distance television was demonstrated by the Bell engineers, when Mr. Hoover, then Secretary of Commerce, sat in front of a machine in Washington and was seen and heard in New York. This was the result of researches of a group of scientists under the direction of Dr. Herbert E. Ives. Years ago Dr. Ives' father, Frederic E. Ives, of Philadelphia, invented one of the first successful methods of color photography. The new method of color television is essentially a combination of these two achievements of father and son.

DR. HERBERT E. IVES, at the color television receiver

In the Ives color photography, three photographs were made of the same scene. One was taken through a red glass filter, and recorded the reds of the scene. Another was taken through a blue filter and recorded all the areas of this color, while a plate exposed behind one of green showed all the greens. These were made into lantern slides. In a triple magic lantern all three were projected on the same screen. Over the slide showing the reds was placed a red glass, over the one showing the greens a green glass and over the third a blue glass. Thus, all three colors of the original scene were combined on the screen, and a natural color reproduction was the result.

A method used by Mr. Ives, Sr., in a later color camera to combine three images is now used to combine the light from three glow lamps in the color television receiver.

The following article, by Dr. Herbert Ives, tells the details of the new method. Previous television achievements of Dr. Ives and his colleagues were described in the SCIENCE NEWS-LETTER for April 16, 1927, page 237, and for July 21, 1928, page 35.

Science News-Letter, July 6, 1929

Television in Color

Television

By HERBERT E. IVES
Member of the Technical Staff,
Bell Telephone Laboratories

Over two years ago Bell Telephone Laboratories demonstrated a practical system of television. For the first time successful representations of objects at rest or in motion were transmitted electrically — over wires or through the ether—for considerable distances. The reproduction of the scene then transmitted was in monochrome—the orange-red color of the neon lamp. Recent developments of the laboratories, however, have made it possible to reproduce scenes with their true color values. The appearance of reality in the reproduced scene is thus greatly enhanced.

One of the most significant features of this new achievement is that it does not require completely new apparatus. The same light sources, driving motors, scanning discs, synchronizing systems, and the same type of circuit and method of amplification are used as in the monochromatic system. The only new features are the type and arrangements of the photo-electric cells at the sending end, and the type and arrangements of the neon and argon lamps at the receiving end. The outstanding contributions that have made the present achievement possible are a new photo-electric cell, new gas cells for reproducing the image, and the equipment associated directly with them.

To render the correct tone of colored objects, it was necessary to obtain photo-electric cells which—like the modern orthochromatic or panchromatic plate—would be sensitive throughout the visible spectrum. This requirement has been satisfactorily met. Through the work of A. R. Olpin and G. R. Stilwell a new kind of photoelectric cell has been developed, which uses sodium in place of potassium. Its active surface is sensitized by a complicated process using sulphur vapor and oxygen instead of by a glow discharge of hydrogen as with the former type of cell.

The response of the new cell to color, instead of stopping in the blue-green region, continues all the way to the deep red. Because the former potassium cells were responsive only to the blue end of the spectrum, obects of a yellowish color appeared darker than they should have and the tone of the reproduced scene was not quite correct. This disadvantage applied particu- (*Turn to next page*)

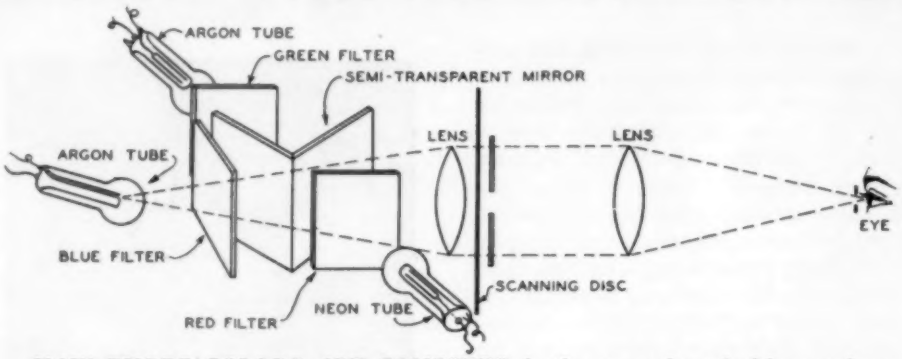
Television in Color—*Continued*

larly to persons of dark or tanned complexion. When the new cells are used in the original television apparatus and with yellow filters—similar to those used in photographing landscapes in order to make the blue sky appear properly dark—this defect is corrected and the images assume their correct values of light and shade no matter what the color of the object or the complexion of the sitter. It is the availability of the new photo-electric cells which makes color television possible by their use.

The development of color television has been greatly simplified by the fact that as far as the eye is concerned any color may be represented by the proper mixture of just three fundamental colors—red, green, and blue. This fact was utilized in the development of color photography, and all the research that had been done in that field was available as background for color television. A host of methods of combining the three basic colors to form the reproduced image was available but, insofar as the sending or scanning end is concerned, a method was developed which has no counterpart in color photography. The method of "beam scanning"—used in the first television demonstration—has been employed.

To apply this method to color television, three sets of photo-electric cells are employed in place of the one set used before. Each of these sets is provided with color filters made up of sheets of colored gelatin. One set has filters of an orange-red color which make the cells see things as the hypothetical red sensitive nerves of the retina see them; another set has yellow-green filters to give the green signal, and the third set has greenish-blue filters which perform a corresponding function for the blue constituent of vision. The scanning disc and the light source are the same as with the beam scanning arrangement used in monochromatic television. The only difference is in the photo-electric cells, and thanks to the tri-chromatic nature of color vision, it is only necessary to have three times the number of cells used previously to reproduce all colors. Three series of television signals, one for each set of cells, are generated instead of one and three channels are used for the transmission of the television signals.

The photo-electric cell container, or "cage," has been built in a somewhat different form from that used in our first demonstration. There three cells were used arranged in an inverted "U" in a plane in front of the object. In the new photo-cell cage twenty-four cells are employed, two with "blue" filters, eight with "green" filters, and fourteen with "red" filters. These numbers are so chosen with respect to the relative sensitiveness of the cells to different colors that the photo-electric signals are of about equal value for the three colors. The cells are placed in three banks, one bank in front of and above the position of the scanned object, one bank diagonally to the right, and another bank diagonally to the left, so that the cells receive light from both sides of the object and above. In placing the cells they are so distributed by color as to give no predominance in any direction to any color. In addition, large sheets of rough pressed glass are set up some distance in front of the cell containers so that the light reflected from the object to the cells is well diffused.



HOW THREE COLORS ARE COMBINED in the new color television receiver

The television signals produced in the color sensitive photo-electric cells through the color filters are no different electrically from those used in monochromatic television. Three sets of amplifiers are required, one for each color, and three communication channels in place of one, but the communication channels are exactly similar to those which were used with the same scanning disc before.

For color television the thre images must be received in their appropriate colors, and viewed simultaneously and in superposition. The first problem was to find light sources which, like the neon lamp previously used, would respond with the requisite fidelity to the high-frequency signals of television, and at the same time give red, green and blue light. With such lamps available a decision would have to be made as to how the three colors could best be combined to form a single image.

Several methods of reception are possible. For displaying the transmitted image to a large audience a grid could be employed similar to that used for the earlier demonstration, but it would consist of three parallel tubes instead of a single one.

Thus far the television images have been received in a manner similar essentially to our method for monochromatic television. The surface of a disc similar to that used at the sending end is viewed, and the light from the receiving lamp is focussed on the pupil of the observer's eye by suitable lenses. To combine the light of the three lamps, they are placed at some distance behind the scanning disc and two semi-transparent mirrors are set up at right angles to each other but each at 45° to the line of sight. One lamp is then viewed directly through both mirrors and one lamp is seen by reflection from each, as illustrated by the accompanying diagram.

The matter of suitable lamps to provide the red, green, and blue light has required a great deal of study. There is no difficulty about the red light because the neon glow lamp which has been used previously in television can be transformed into a suitable red light by interposing a red filter. For the sources of green and blue light nothing nearly so efficient as the neon lamp was available. The decision finally made was to use another one of the noble gases—argon—which has a very considerable number of emission lines in the blue and green region of the spectrum. Two argon lamps are employed, one with a blue filter to transmit the blue lines and one with a green filter transparent to the green lines of its spectrum.

These argon (*Turn to page* 5)

Men and Woodpeckers Alike

Ornithology

By WILLIAM E. RITTER
Honorary President, Science Service

California woodpeckers are like men in taking some thought for the morrow. They gather into barns, at least to the extent of sticking acorns into holes which they bore into trees. I have been watching them a good deal lately, to learn more about the way these birds use their heads (chiefly brains and beaks) in solving their economic and social problems.

That they gain a real advantage by their unique provisioning activity is quite clear; and some aspects of the performance are surprisingly well done. But what wastefulness and inefficiency, even to the crassest foolishness, the birds show in some other aspects of their work! A lot of this is due to their doing altogether too much. Hole-making for acorn-storing is a fine thing and is great fun; so the birds go right on making holes whether they are going to put acorns in them or not.

Likewise, gathering acorns and putting them in holes is a fine thing, and great sport besides. Consequently, acorn-storing it is, day in and day out, as long as the acorn harvest lasts, with very little regard for what the actual needs of the future may be or even as to whether the nuts are being put where they can be got if the effort is made to get them later on.

Some of the collections I have made are of acorns converted into mere rubbish by decay and insect-eating, so long ago and so unprotectedly were they stored.

What has made this field work especially interesting to me was the opportunity to observe the similarity between the way California woodpeckers and California men act in relation to their economic problems. ,

For instance, on the same day one may observe woodpeckers producing acorn stores far beyond any need or consuming ability of theirs; likewise, men producing raisin grapes in quantities beyond the possibility of disposing of them to anybody's good, and oil men pumping oil out of the ground with all the speed and force they can muster with very little regard to the real need, present or future, for oil by the community.

Science News-Letter, July 6, 1929

Television in Color—*Continued*

lamps, unfortunately, are not nearly so bright as neon lamps and it was, therefore, necessary to use various expedients to increase their effective brilliancy. Special lamps to work at high current densities were constructed with long, narrow and hollow cathodes so that streams of cold water could cool them. The cathode is viewed end-on. This greatly foreshortens the thin glowing layer of gas and thus increases its apparent brightness. Even so it is necessary to operate these lamps from a special "I" tube amplifier to obtain currents as high as 200 milliamperes.

The receiving apparatus at present consists of one of the 16-inch television discs used in our earlier experimental work. Behind it are the three special lamps and a lens system which focusses the light into a small aperture in front of the disc. The observer looking into this aperture receives, through each hole of the disc as it passes by, light from the three lamps—each controlled by its appropriate signal from the sending end. When the intensities of the three images are properly adjusted he therefore sees an image in its true colors, and with the general appearance of a small colored motion picture.

Satisfactory television in colors is a far more difficult task than is monochromatic television. Errors of quality which would pass unnoticed in an image of only one color may be fatal to true color reproduction where three such images are superimposed and viewed simultaneously. In three-color television any deviations from correct tone rendering throw out the balance of the colors so that while the three images might be adjusted to give certain colors properly, others would suffer from excess or deficiency of certain of the constituents.

Color television constitutes a definite further step in the solution of the many problems presented in the electrical communication of images. It is, however, obviously more expensive as well as more difficult than the earlier monochromatic form, involving extra communication channels as well as additional apparatus.

Science News-Letter, July 6, 1929

First Glances at New Books

THE SUMERIANS—C. Leonard Woolley—*Clarendon Press, Oxford* ($2.50). Students and other readers who really want to know more about the temples and royal tombs of Ur of the Chaldees will find here a thorough account and will be quite satisfied with the clear explanations and fine photographs. The little volume might have had a wider popular appeal had Mr. Woolley seen fit to recount the manner and procedure in which some of his remarkable finds have been made, and had he presented the richly picturesque existence of the kings of Ur in a more dramatic literary fashion. We are still waiting for those kings to "come alive" as Tutankhamen has done. But then, perhaps, that is another book and another story.

Archæology
Science News-Letter, July 6, 1929

OLD CIVILIZATIONS OF THE NEW WORLD—A. Hyatt Verrill—*Bobbs-Merrill* ($5). The most solid and spectacular cultures that developed on American soil—chiefly those of the tropics and sub-tropics—are described, so that the layman may better understand and compare the achievements of the Aztecs, the Incas, and the rest.

Archæology
Science News-Letter, July 6, 1929

BEFORE COLUMBUS—Cecil E. Stevens—*Silver, Burdett* ($1.32). How the Indians of Porto Rico lived before the coming of the white man, told simply in story form for child readers. A good antidote for the idea often gained by children that America before the days of Columbus was merely a wilderness in which painted savages ran wild. The folklore tales brought into the narrative have the color and romance of popular fairy stories.

Ethnology
Science News-Letter, July 6, 1929

OPINIONS RENDERED BY THE INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE: 105 to 114—*Smithsonian Institution.* Of interest to systematic zoologists.

Taxonomy
Science News-Letter, July 6, 1929

THE ARCHERS HANDBOOK—Philip Rounsevelle—*The Archers Company, Pinehurst, N. C.* (25c). A company of craftsmen tell in brief compass the most important facts about the ancient sport of archery and the implements employed therein.

Sports
Science News-Letter, July 6, 1929

NATURE RAMBLINGS

By FRANK THONE

Potato Beetle

The great state of Colorado received a totally undeserved black eye when popular nomenclature settled upon "Colorado Potato Beetle" as the accepted designation of the ten-lined devouring pest that saddens truck-raisers and gladdens manufacturers of arsenical sprays and of appliances to spread the same on potato fields. For the potato beetle is not a native of Colorado, but of Mexico, and the only thing that Colorado had to do with it was to be the first considerable potato-raising region that lay athwart the path of invasion. After fattening in Colorado fields, the beetles spread over the rest of the country, dragging the good name of their first unwilling host in the dust.

One thing that has helped in the rapid spread of potato beetles is the unwillingness of almost all birds to eat them. There must be something ill-tasting or disgusting about the brown juice secreted by both the hard-shelled adults and the nasty, squidgy red larvae, for not even the usually omnivorous hen will eat them. That has left only two enemies: small boys, unwillingly drafted, and the more wholesale-killing spray gun.

One bird, however, is credited with an appetite for potato beetles. Prof. E. L. Moseley of the Ohio State Normal College at Bowling Green declares that he has seen bob-white, or American quail, systematically "working" rows of potatoes, cleaning off the beetles as no small boy ever could, because the bird can work from underneath and catch them as they lurk beneath the leaves. In places where adequate and well-enforced game laws have given the bob-white a chance to increase in numbers, says Professor Moseley, it is often unnecessary to spray the potato crop at all.

Measures Plates

Physics

A stereopticon, or "magic lantern" and a photoelectric cell, which converts light to electricity, are the chief parts of a simple apparatus for measuring photographic plates described by Dr. Cedric E. Hesthal and Dr. George R. Harrison of Stanford University at the meeting of the American Physical Society and the Pacific Division of the American Association for the Advancement of Science.

The device is used in such researches as those of spectroscopy, where it is necessary to measure the intensity of a series of dark lines crossing the plate. The plate is put in the stereopticon in place of the slide, and moved along so that its image on the screen passes across a small slit. Back of the slit is the photo-electric cell, connected with current measuring apparatus, arranged to plot the current changes as a curve. This curve corresponds to the intensity changes of the lines.

Science News-Letter, July 6, 1929

Oxygen, Life Gas, Proven Triplets

Chemistry

Oxygen, the gas which constitutes a fifth of the air we breathe, and which is essential to our life, is really triplets. It is not twins, as was recently suggested, or single, as it was thought for many years.

This has been discovered by two University of California experimenters, Prof. W. F. Giauque and H. L. Johnstone. They have found that oxygen in the air consists not only of the element with atomic weight of 16, but that there are small numbers of heavier atoms. Some weigh 17 and others weigh 18. These make up forms of oxygen which are like ordinary oxygen in all respects except atomic weight, and are called isotopes of oxygen. Many other elements, notably lead, have been found to have isotopes, chemically similar, but of different atomic weight.

The investigators have discovered this fact from a study of the way light is absorbed as it passes through a thick layer of air, as with sunlight in the late afternoon. The oxygen absorbs certain wave lengths of light, and from these, Prof. Giauque and Mr. Johnstone have calculated the weight of the atoms that produce the effect. Recently they found that some of the oxygen molecules were made of an atom of weight 16 combined with one of weight 18. Since they announced this, they have discovered the presence of the third isotope, so that there is still a third kind of oxygen molecule, consisting of an atom of weight 16 combined with one of weight 17. However, the atoms of weight 16 must be in the vast majority, and the typical molecule must consist of a pair of atoms of weight 16, as the atomic weight of ordinary oxygen has been determined to be 16 with great precision. Any great amount of the other isotopes would make the average atomic weight of oxygen appreciably greater than this figure.

Science News-Letter, July 6, 1929

May Prescribe Ice Cream

Physiology

Small boys and girls will welcome the news that irradiated ice cream may be used as a cure for rickets and may even be substituted for cod-liver oil in treating or preventing that disease of childhood. Of course, in these days of scientific child-rearing, the youngster is supposed to relish his cod-liver oil and ask for more. However, science has not yet spoiled children's taste for ice cream, so the success of irradiated ice cream, reported by the Department of Dairy Husbandry of Rutgers College in the *Journal of Dairy Science,* will doubtless be extremely popular with the younger set.

Since the discovery by Doctor Steenbock of the University of Wisconsin of the process for rendering certain foods valuable in prevention and treatment of rickets by exposing these foods to the effect of rays from an ultraviolet lamp, many experiments have been conducted using dairy products. Milk and milk products have been subjected to this process. In the experiment conducted at Rutgers College ice cream was exposed to ultraviolet rays with favorable results.

The dairy products for the ice cream mixes were from cows which were in the barn most of the time and were obtained at a time of the year when the ultra-violet intensity of the sun's rays was low. The ice cream mixes were made according to commercial processes and were then submitted to light from a quartz-mercury vapor lamp at a distance of 12 inches for two and ten minute periods. It was found that the ice cream exposed to the lamp's rays for ten minutes acquired a fishy flavor which was attributed to absorption of some of the ozone generated by the lamp. The flavor of the ice cream which was exposed for only two minutes was not objectionable.

Two groups of rats in which rickets had been induced were used. One group was fed on the irradiated ice cream and the other on ice cream from the same mix which had not been exposed to the lamp. It was found that the irradiated ice cream healed rickets, whereas the non-irradiated ice cream did not produce any healing effect.

Further tests demonstrated that freezing and low-storage temperature do not affect the antirachitic value of the irradiated ice cream for at least two months.

Science News-Letter, July 6, 1929

Long-Range Forecasts

Meteorology

Predicting weather conditions a whole season in advance may be taken out of the realm of guesswork and "goosebone prophecies" by scientific studies of the ocean. At the meeting of the Pacific division of the American Association for the Advancement of Science, A. F. Gorton, of the Scripps Institution of Oceanography, outlined recent work leading in this direction.

In Southern California heavy winter rains are usually experienced when cyclonic storms strike the land at low latitudes. The location of a permanent area of high atmospheric pressure, which hovers over the North Pacific, determines the course of these storms, and the scientists are now engaged in an endeavor to learn what factors affect its position and movements.

Science News-Letter, July 6, 1929

X-Ray Detects Diamonds

Physics

To locate diamonds swallowed or concealed beneath the skin of those attempting to smuggle them out of the Union of South Africa, government authorities at Port Nolloth are installing an X-ray machine with which suspects can be searched.

Science News-Letter, July 6, 1929

Saturn Now in Southern Sky

Astronomy

By James Stokley

When one first begins to learn the names of the constellations, such as the Great Bear, the Crab, the Eagle, the Lion, and so on, it is hard to see any resemblance between the actual configuration and the object represented. Perhaps the ancient people who gave the names to them had more vivid imaginations than we moderns, and could see the figure of Hercules, for instance, in the "K"-shaped group of stars overhead in the evening sky.

One constellation, however, that is now in a prominent place, has some excuse for its name. It is Scorpio, the Scorpion, now low in the southern sky in the evening. The forepart of the scorpion's body is partly represented, but the curved row of stars extending to the east and curling upwards, bears a striking resemblance to the tail of the scorpion. In very ancient times, the scorpion was considered as extending much farther to the west, including what is now the constellation of Libra, the Scales. The bright red star in Scorpio is Antares, the name of which means "the rival of Mars".

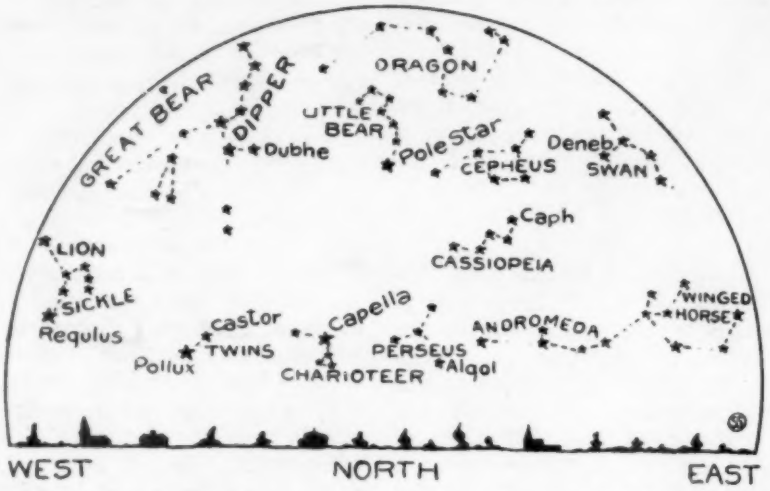
This month the constellation of the Scorpion is particularly distinguished by the presence of another body which appears as a first-magnitude star. However, its steady yellowish light makes it appear different from the scintillating stars nearby and shows that it is a planet. This body is Saturn, unique among all astronomical bodies in that it is surrounded by the flat ring which was discovered by the Dutch astronomer Huygens in 1655. Previously, Galileo had observed them, but to his inferior telescope they appeared as two companion globes, which disappeared and then came into view a few years later.

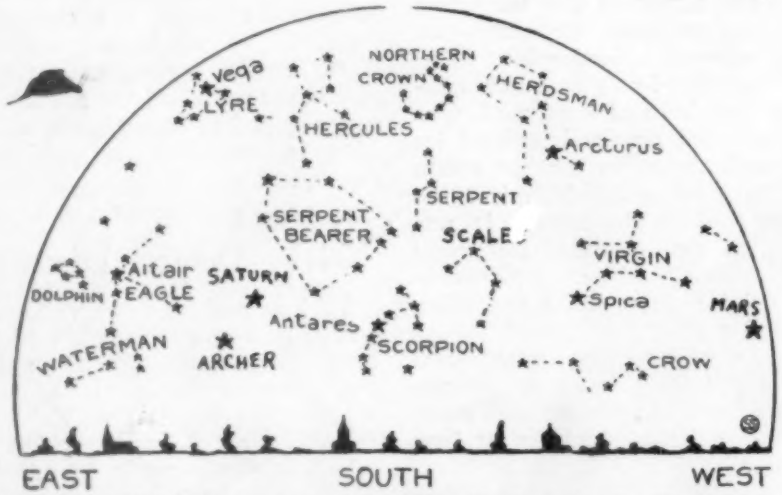
Then, in the year 1675, the French astronomer, Cassini, found that the ring was double, that is separated by a broad space now known as Cassini's division. In 1850 Professor Bond, of the Harvard College Observatory, discovered a third ring inside the other two, but much fainter, and so it is known as the dusky crepe ring. Undoubtedly this crepe ring had at that time become somewhat more prominent than it had in the past, for two weeks after Bond found it, an English astronomer named Dawes discovered it independently.

The reason for the strange disappearance of the appendages that Galileo observed is that the plane of the rings is inclined to the plane in which Saturn moves. The planet travels around its orbit once in thirty years. Twice during this time the rings are directly in line with the earth. On such occasions, all we may see is the edges of the rings, and as they are very thin they disappear almost completely from view with even the largest telescope. Seven years later the rings present their largest area to us and so are especially prominent. The last disappearance of the rings was in 1921, so that now they are almost at full width, though they have begun to narrow. About 1935 they will disappear again.

Except for Mars, all of the other planets have disappeared from the evening sky.

The summer skies are characterized by six first magnitude stars. High overhead is Vega, in the constellation of Lyra, the Lyre; below it to the northeast is Deneb in Cygnus, the Swan. This constellation is also known as the northern cross, and Deneb is at the top of the cross. About the same height as Deneb in the northeastern sky is Altair, in Aquila, the Eagle. These three bright stars, in the same part of the sky, forming a huge triangle, make a good reference figure from which to learn the constellations. High in the western sky is Arcturus, in Bootes, the bear driver. Low in the south is Antares in Scorpio, which have already been mentioned. Spica in the southwest, in Virgo, the Virgin, completes the first magnitude stars that decorate the summer evening skies.





HOLD THESE MAPS in front of you and face North or South. The upper or lower one will then show the stars of the July evening sky

Science News-Letter, July 6, 1929